PCT

世界知的所有権機関
国　際　事　務　局

特許協力条約に基づいて公開された国際出願

(51) 国際特許分類 5
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(81) 指定国
AT(欧州特許), BE(欧州特許), CH(欧州特許), DE(欧州特許),
FR(欧州特許), GB(欧州特許), IT(欧州特許), JP,
LU(欧州特許), NL(欧州特許), SE(欧州特許), US.

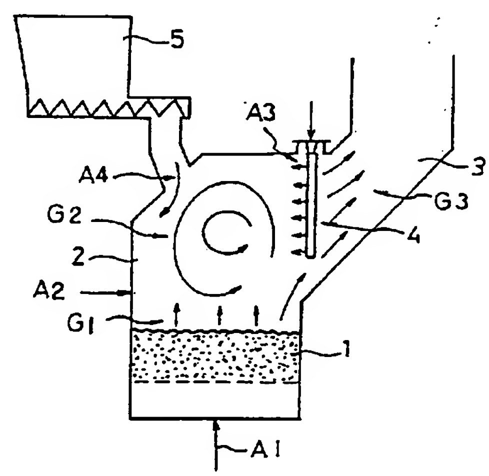
添付公開書類　国際調査報告書

(54) Title: COMBUSTION APPARATUS AND ITS COMBUSTION CONTROL METHOD

(54) 発明の名称　燃焼装置及びその燃焼制御方法

(57) Abstract

In a combustion apparatus having a structure which includes a combustion furnace portion (1), a free board portion (2) continuing from the combustion furnace portion (1) and a post-combustion chamber (3) continuing from the free board portion (2) and wherein the post-combustion chamber (3) is disposed deviated from the position immediately above the free board portion (2), the combustion apparatus of this invention includes a plurality of pipes (4-2) disposed in parallel with a predetermined gap between them and near the boundary between the free board portion (2) and the post-combustion chamber (3) and gas blow means (4) equipped with gas jet holes (4-3) for blowing a gas such as air in a direction opposite to a combustion gas flowing to a discharge port, in each of the pipes (4-2). According to this structure, the gas blow means (4) blows the gas in such a manner as to counter the combustion gas so that a great swirl flow consisting of the mixture of the combustion gas and the blown gas occurs at the free board portion (2), an unburnt gas and the combustion air are mixed sufficiently inside the free board portion (2) and complete combustion is accomplished.



(57) 要約

燃焼炉部（１）と、該燃焼炉部（１）に続くフリーボード部（２）と、該フリーボード部（２）に続く後燃焼室（３）を具備し、該後燃焼室（３）がフリーボード部（２）の真上からずれた位置に配置された構造の燃焼装置において、フリーボード部（２）と後燃焼室（３）との境界近傍に、所定の間隔平行に配置された複数本のパイプ（４－２）を有し、該パイプ（４－２）のそれぞれには排出口に向かって流れる燃焼ガスに対向する向きに空気等のガスを吹き込むガス噴出穴（４－３）が設けてなるガス吹き込み手段（４）を設けたことを特徴とする。このように構成することにより、ガス吹き込み手段（４）から燃焼ガスに対向してガスを吹き込むことにより、フリーボード部（２）に燃焼ガスと吹き込みガスとが混合する大きな旋回流が生じ、該フリーボード部（２）内で未燃ガスと燃焼用空気との十分な混合が行なわれ、完全燃焼が行なわれる。

情報としての用途のみ
PCTに基づいて公開される国際出願のパンフレット第1頁にPCT加盟国を同定するために使用されるコード

AT オーストリア
AU オーストラリア
BB バルバードス
BE ベルギー
BF ブルキナ・ファソ
BG ブルガリア
BJ ベナン
BR ブラジル
CA カナダ
CF 中央アフリカ共和国
CG コンゴー
CH スイス
CM カメルーン
DE 西ドイツ
DK デンマーク
ES スペイン
FI フィンランド
FR フランス
GA ガボン
GB イギリス
HU ハンガリー
IT イタリー
JP 日本
KP 朝鮮民主主義人民共和国
KR 大韓民国
LI リヒテンシュタイン
LK スリランカ
LU ルクセンブルグ
MC モナコ
MG マダガスカル
ML マリー
MR モーリタニア
MW マラウイ
NL オランダ
NO ノルウェー
RO ルーマニア
SD スーダン
SE スウェーデン
SN セネガル
SU ソビエト連邦
TD チャード
TG トーゴ
US 米国

INTERNATIONAL SEARCH REPORT

International Application No PCT/JP89/01070

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl^5 F23G5/00, 5/30, 5/44, 5/46, 5/50, F23C11/02

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC	F23G5/00, 5/30, 5/44, 5/46, 5/50, F23C11/02, C01B31/36

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

Jitsuyo Shinan Koho 1926 - 1989
Kokai Jitsuyo Shinan Koho 1971 - 1989

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
A	JP, A, 58-156107 (Ishikawajima-Harima Heavy Industries Co., Ltd.), 17 September 1983 (17. 09. 83), (Family: none)	1, 6
A	JP, A, 60-29508 (Ebara Corporation), 14 February 1985 (14. 02. 85), Figs. 3, 4, (Family: none)	1
A	JP, B2, 63-24201 (Foster Wheeler Energy Corp.), 19 May 1988 (19. 05. 88), Fig. 4, (Family: none)	2, 3
A	JP, A, 60-86320 (Kawasaki Heavy Industries, Ltd.), 15 May 1985 (15. 05. 85), (Family: none)	2, 3
A	JP, B2, 61-9246 (The Foundation: The Research Institute For Special Inarganic Moderials),	4

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
January 9, 1990 (09. 01. 90)	January 22, 1990 (22. 01. 90)
International Searching Authority	**Signature of Authorized Officer**
Japanese Patent Office	

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

	20 March 1986 (20. 03. 86), Column 1, lines 17 to 22, (Family: none)	
A	JP, A, 61-215210 (Toyota Motor Corporation), 25 September 1986 (25. 09. 86), Column 1, lines 16 to 20, (Family: none)	4
A	JP, A, 63-189709 (Ebara-Infilco Co., Ltd.), 5 August 1988 (05. 08. 88), Drawing, (Family: none)	5

V.☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE [1]

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1.☐ Claim numbers ...., because they relate to subject matter not required to be searched by this Authority, namely:

2.☐ Claim numbers ...., because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3.☐ Claim numbers ...., because they are dependent claims and are not drafted in accordance with the second and third sentences of PCT Rule 6.4(a).

VI.☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING [2]

This International Searching Authority found multiple inventions in this international application as follows:

1.☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2.☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3.☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4.☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

☐ The additional search fees were accompanied by applicant's protest.

☐ No protest accompanied the payment of additional search fees.

International Application No. PCT/JP89/01070

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

A	JP, B2, 59-43682 (Babcock-Hitachi Kabushiki Kaisha), 24 October 1984 (24. 10. 84), (Family: none)	6 - 9
A	JP, A, 53-105071 (Ishigaki Kiko Kabushiki Kaisha), 12 September 1978 (12. 09. 78), (Family: none)	6 - 9
A	JP, A, 62-182519 (Ishikawajima-Harima Heavy Industries Co., Ltd.), 10 August 1987 (10. 08. 87), (Family: none)	6 - 9

V.☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE [1]

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1.☐ Claim numbers ...., because they relate to subject matter not required to be searched by this Authority, namely:

2.☐ Claim numbers .. .., because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3.☐ Claim numbers ...., because they are dependent claims and are not drafted in accordance with the second and third sentences of PCT Rule 6.4(a).

VI.☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING [2]

This International Searching Authority found multiple inventions in this international application as follows:

1.☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2.☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3.☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4.☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

☐ The additional search fees were accompanied by applicant's protest.

☐ No protest accompanied the payment of additional search fees.

国際調査報告

国際出願番号PCT/JP89/01070

Ⅰ. 発明の属する分野の分類	
国際特許分類（IPC）	Int. Cl⁵ F23G5/00，5/30，5/44，5/46，5/50，F23C11/02

Ⅱ. 国際調査を行った分野

調査を行った最小限資料	
分類体系	分類記号
IPC	F23G5/00，5/30，5/44，5/46，5/50， F23C11/02，C01B31/36

最小限資料以外の資料で調査を行ったもの

日本国実用新案公報	1926－1989年
日本国公開実用新案公報	1971－1989年

Ⅲ. 関連する技術に関する文献

引用文献のカテゴリー※	引用文献名　及び一部の箇所が関連するときは、その関連する箇所の表示	請求の範囲の番号
A	JP，A，58－156107（石川島播磨重工業株式会社），17．9月．1983（17．09．83）（ファミリーなし）	1，6
A	JP，A，60－29508（株式会社　荏原製作所），14．2月．1985（14．02．85），第3，4図（ファミリーなし）	1
A	JP，B2，63－24201（フオスター・ホイーラー・エナージイ・コーポレイション），19．5月．1988（19．05．88），第4図（ファミリーなし）	2，3
A	JP，A，60－86320（川崎重工業株式会社），15．5月．1985（15．05．85）（ファミリーなし）	2，3
A	JP，B2，61－9246（財団法人　特殊無機材料研究所），	4

※引用文献のカテゴリー
「A」特に関連のある文献ではなく、一般的技術水準を示すもの
「E」先行文献ではあるが、国際出願日以後に公表されたもの
「L」優先権主張に疑義を提起する文献又は他の文献の発行日若しくは他の特別な理由を確立するために引用する文献（理由を付す）
「O」口頭による開示、使用、展示等に言及する文献
「P」国際出願日前で、かつ優先権の主張の基礎となる出願の日の後に公表された文献
「T」国際出願日又は優先日の後に公表された文献であって出願と矛盾するものではなく、発明の原理又は理論の理解のために引用するもの
「X」特に関連のある文献であって、当該文献のみで発明の新規性又は進歩性がないと考えられるもの
「Y」特に関連のある文献であって、当該文献と他の1以上の文献との、当業者にとって自明である組合せによって進歩性がないと考えられるもの
「&」同一パテントファミリーの文献

Ⅳ. 認証

国際調査を完了した日 09．01．90	国際調査報告の発送日 22.01.90
国際調査機関 日本国特許庁（ISA/JP）	権限のある職員　3K 7815 特許庁審査官　前田　仁

第2ページから続く情報

	(Ⅲ欄の続き) 20. 3月. 1986(20. 03. 86), 第1欄第17－22行(ファミリーなし)	
A	JP, A, 61－215210(トヨタ自動車株式会社), 25. 9月. 1986(25. 09. 86), 第1欄第16－20行(ファミリーなし)	4
A	JP, A, 63－189709(荏原インフイルコ株式会社), 5. 8月. 1988(05. 08. 88), 図面(ファミリーなし)	5

V. ☐ 一部の請求の範囲について国際調査を行わないときの意見

次の請求の範囲については特許協力条約に基づく国際出願等に関する法律第8条第3項の規定によりこの国際調査報告を作成しない。その理由は、次のとおりである。

1. ☐ 請求の範囲＿＿＿＿＿は、国際調査をすることを要しない事項を内容とするものである。

2. ☐ 請求の範囲＿＿＿＿＿は、有効な国際調査をすることができる程度にまで所定の要件を満たしていない国際出願の部分に係るものである。

3. ☐ 請求の範囲＿＿＿＿＿は、従属請求の範囲でありかつPCT規則6.4(a)第2文の規定に従って起草されていない。

VI. ☐ 発明の単一性の要件を満たしていないときの意見

次に述べるようにこの国際出願には二以上の発明が含まれている。

1. ☐ 追加して納付すべき手数料が指定した期間内に納付されたので、この国際調査報告は、国際出願のすべての調査可能な請求の範囲について作成した。
2. ☐ 追加して納付すべき手数料が指定した期間内に一部分しか納付されなかったので、この国際調査報告は、手数料の納付があった発明に係る次の請求の範囲について作成した。
請求の範囲＿＿＿＿＿
3. ☐ 追加して納付すべき手数料が指定した期間内に納付されなかったので、この国際調査報告は、請求の範囲に最初に記載された発明に係る次の請求の範囲について作成した。
請求の範囲＿＿＿＿＿
4. ☐ 追加して納付すべき手数料を要求するまでもなく、すべての調査可能な請求の範囲について調査することができたので、追加して納付すべき手数料の納付を命じなかった。

追加手数料異議の申立てに関する注意

☐ 追加して納付すべき手数料の納付と同時に、追加手数料異議の申立てがされた。
☐ 追加して納付すべき手数料の納付に際し、追加手数料異議の申立てがされなかった。

III. 関連する技術に関する文献（第２ページからの続き）

引用文献の カテゴリー※	引用文献名及び一部の箇所が関連するときは、その関連する箇所の表示	請求の範囲の番号
A	JP, B2, 59－43682（バブコック日立株式会社）, 24. 10月. 1984（24. 10. 84）（ファミリーなし）,	6－9
A	JP, A, 53－105071（石垣機工株式会社）, 12. 9月. 1978（12. 09. 78）（ファミリーなし）,	6－9
A	JP, A, 62－182519（石川島播磨重工業株式会社）, 10. 8月. 1987（10. 08. 87）（ファミリーなし）	6－9

COMBUSTION APPARATUS AND COMBUSTION CONTROL METHOD FOR THE SAME

Background of the Invention

1. Field of the Invention

The present invention relates to a combustion apparatus for protecting an exhaust of slight hazardous substances, such as dioxin and the like, and also carrying out a combustion at a high combustion efficiency by carrying out the combustion of a high temperature and a high efficiency at a low air ratio, in a combustion apparatus, such as a combustion furnace and the like, for combusting wastes, such as city refuses and the like, and a combustion control method for the same.

2. Description of the Related Art

In recent years, the diversification of a distributing system and the like causes the increase in plastic, fiber, paper and the like in city refuses. Consequently, the city refuses gradually exhibit the tendency of high calorie.

In a case of the plastic and the like, at a time of a combustion process, a locally high temperature and heat generation causes the damage to a refractory material and the occurrence of a clinker, which disturbs the

continuous operation of a furnace and the rated amount combustion of the refuses. Thus, there is a separating method as a substance unsuitable for combustion. However, it is difficult to perfectly separate the plastic and the like from the city refuses. Also, if the separated plastic and the like are used for embedding without any combustion, the substance which may serve as a valuable energy source is embedded and treated without any execution of effective utilization.

Also, when the high calorie refuse is combusted and processed in its original state, a gas temperature at a furnace outlet is kept at 700 ℃ to 950 ℃. Thus, it must be cooled by using a large amount of air or atomized water. Actually, the furnace is made larger. Here, the lower limit value (700 ℃) of the gas temperature at the furnace outlet is mainly set in order to protect bad odor. Also, the high limit value (950 ℃) is set from the viewpoint of the furnace operation so that a trouble is not brought about when dust melted at the high temperature is deposited on a flue and the like after an outlet of a combustion room.

On the other hand, in December 1983, hazardous dioxin and the like are detected from

a mechanical furnace that is a stoker type combustion furnace, and this becomes a social problem. The main factor of the occurrence of hazardous organic chlorine compounds, such as poly-chloro-die-benzo-para-dioxin (hereafter, referred to as [PCDDs], poly-chloro-die-benzufran (PCDFs) that is chemically extremely similar to the PCDDs and the like is said to be the plastic and the like. At present, the occurrence is confirmed irrespectively of the type of the combustion furnace such as the mechanical furnace, a fluid bed furnace and the like.

Also, the indication that a chloro-benzene and the like (CBs) and chloro-phenol and the like (CPs) deeply contribute to the occurrence as a precursor is pointed out by many researchers. Then, the tendency that the generation amount is increased in association with the flow of the exhaust gas to the flue from the furnace, namely, the drop in the temperature of the exhaust gas, and the occurrence caused by an electrical discharge effect within an electrical dust collector are reported.

With regard to the generation mechanism of the PCDDs and the like within the combustion furnace, there are still many unknown portions.

However, it is typically said to be generated at 700 ℃ or less, and it is said to be decomposed by an oxidizing process at 900 ℃ to 1200 ℃.

In the case of the mechanical furnace, the inside of a laminated waste on a stoker at a furnace bottom is at a condition baked at 300 ℃ to 400 ℃. There is a region in which the dioxin is easily generated. Moreover, a combustion air ratio is high, such as 2 or more, in the mechanical furnace. Thus, a rate cooled by air is high. It is difficult to increase the temperature at an upper portion of the furnace to 1200 ℃ unless the heat generation amount of the combustion substance is high. Also, the high heat generation amount leads to the local portion of a very high temperature, which results in the problems of the damage to the refractory material and the occurrence of the clinker.

In the case of the fluid bed type combustion furnace, a furnace bottom is constituted by a fluid bed composed of fluid medium such as silica sand and the like. Usually, it is substantially driven at 700 ℃ to 900 ℃. Thus, this is advantageous over the mechanical furnace. However, in the fluid bed type combustion furnace, the inside of the fluid

bed is a complexly chemical reaction region. Even in the case of the fluid bed, it is difficult to say that the generation of the dioxin and the like can be surely protected.

Typically, the fluid bed type combustion furnace for combusting and processing the city refuses uses the silica sand (SiO_2) having an average particle diameter of about 0.4 to 2.0 mm as a fluid medium, and substantially keeps a temperature of a fluid bed composed of this fluid medium at 700 ℃ to 900 ℃, and then combusts the city refuses supplied into the fluid bed, and again returns the heat generated in association with the combustion to the fluid medium, and thereby carries out the combustion.

By the way, the silica sand serving as the fluid medium reacts with the following alkaline metallic compound and the like under a high temperature region, and it becomes, for example, silicate of soda ($Na_2O\ 3SiO_2$) in a shape of water glass, and the fluidization becomes impossible. Thus, the temperature of the fluid bed has the limitation based on a combustion process target.

$3SiO_2 + Na_2CO_3 \rightarrow Na_2O\ 3SiO_2 + CO_2$

$3SiO_2 + 2NaOH_3 \rightarrow Na_2O\ 3SiO_2 + H_2O$

$3SiO_2 + 2Na_2HCO_3 \rightarrow Na_2O\ 3SiO_2 + H_2O + 2CO_2$

That is, when the alkaline metallic

compound with respect to the fluid medium (SiO_2) amount is represented by a Na element component, if its content weight rate (hereafter, referred to as a Na concentration) is about 0.5 % or less (in a case of a typical city refuse), the material in which the content amount of the alkaline metallic compound is great in sludge, industrial wastes and the like at maximum 900 ℃ and the Na concentration in the fluid medium is about 1 % is suppressed to about 750 ℃ by considering a somewhat safety. By the way, in order to suppress the reaction between the sand and the Na_2CO_3 and the NaOH, the addition of a certain kind of melt suppressant as an additive, for example, kaolin, enables the content wastes, such as the alkaline metallic compound and the like, to be combusted and processed in the fluid bed furnace. Nevertheless, with regard to the retention amount of fluid sand, there is the limit in the supply concentration of the alkaline metallic compound in the waste per unit time. A dead line is known which implies that when it exceeds the limit, even if a large amount of melt suppressant is added, the fluidization is stopped.

In a test of an experimental furnace of the

fluid bed, the Na concentration in the sand when the temperature of the fluid medium (SiO_2) was about 800 ℃ and the fluidization through the alkaline metallic compound was stopped was about 0.6 to 1.8 % although there was a difference on the basis of the kind of the alkaline metallic compound and the melt suppressant. Also, even if the melt suppressant is added, when the particle diameter of the suppressant is thin, it is dispersed simultaneously with the supply into the furnace. Thus, there may be a case that the effect is not exhibited. Moreover, the demerits of a cost-up, an increase in a load on a later stage device and the like are severe. Hence, this can not act as a powerful approach of a measure for the alkaline metallic compound.

It is known that the coexistence of many kinds of alkaline metallic compounds causes the occurrence of a eutectic point and that they are melted at a temperature lower than a melting point of each single alkaline metallic compound. This fact is the important item to which an attention must be paid, in driving and managing the fluid bed furnace. Actually, the amount of the alkaline metallic compounds mixed with the city refuses can not be regulated. Thus, it is

important to manage the temperature of a fluid layer.

Thus, even in the fluid bed combustion furnace, it is desired to keep the temperature of the fluid bed at 900 ℃ or less, and set a temperature of a free board in an upper portion to 900 ℃ to 1200 ℃, and then mix the organic chloride compounds of the dioxin and the like and the precursors thereof with sufficient oxygen, and further carry out the high temperature process.

Also, the melting points of dispersion ashes in the combustion furnace for the city refuses are about 1200 ℃. If the free board is set to 1200 ℃ or more, a trouble of deposition of the dispersion ashes is liable to be induced.

The present invention is accomplished in view of the above mentioned problems. Therefore, an object of the present invention is to provide a combustion apparatus of a high temperature and a high efficiency, which can solve the above-mentioned problems induced when the wastes, such as the city refuses and the like, are combusted by using the combustion apparatus of the fluid bed combustion furnace, without any occurrence of the hazardous substances such as the dioxin and the like, and

a combustion control method for the same.

Summary of the Invention

In order to attain the above-mentioned object, the feature of the present invention lies in a combustion apparatus designed such that the combustion apparatus includes: a combustion furnace; a free board; and a post-combustion room following the free board, and the post-combustion room is placed at a position deviated from a just top of the free board, wherein a gas blower for blowing a gas oppositely to a combustion gas flowing towards an exhaust port is placed near a boundary between the free board and the post-combustion room. 後燃焼室

Also, it is characterized in that the gas blower is provided with a plurality of pipes arrayed at a predetermined interval and in parallel to each other, and a gas discharge hole to blow a gas in a direction opposite to the combustion gas flowing towards the exhaust port is formed in each of the pipes.

Also, it is characterized in that the gas discharge hole formed in each of the plurality of pipes is separated for each pipe.

Also, it is characterized in that the pipe is made of β silicon carbide sinter. β形 炭化ケイ素 焼結体

Also, it is characterized in that a high temperature heat exchanger linked to the post-combustion room is placed, and a gas cooler is placed behind it.

Also, it is characterized in that the combustion furnace is a fluid bed furnace, and a first air amount blown from a bottom of the fluid bed furnace is set at a theoretical air amount or less, and a partial combustion of a combustion substance is carried out in the fluid bed, and a temperature of a fluid bed combustion unit is kept at 400 ℃ to 900 ℃.

Also, it is characterized in that the first air blown from the bottom of the fluid bed is pre-heated to a predetermined temperature by using a two-stage pre-heating unit of an air pre-heater and the high temperature heat exchanger, and the first air amount is reduced to thereby reduce a heat generation amount in the fluid bed, and a temperature of the fluid bed is kept at 400 ℃ to 900 ℃.

Also, it is characterized in that a second air pre-heated by the high temperature heat exchanger is blown into the free board, and an air ratio is set to 1.0 to 1.5, and an oxidized atmosphere of a high temperature is generated, and the gas blower further blows the second air

pre-heated by the high temperature heat exchanger, and a unburned gas and a combustion air are sufficiently mixed, and a combustion of a high temperature and a high efficiency of 950 ℃ or more at a total air ratio of 1.2 to 1.7 is thereby carried out in the free board and the post-combustion room.

Also, it is characterized in that a temperature of the fluid bed, a temperature of the free board and a temperature of the post-combustion room are controlled by changing an air weight ratio between the first air, a second air blown into the free board and a second air blown from the gas blower, and respective air temperatures.

Brief Description of the Drawings

Fig. 1 is a view showing a schematic configuration and a flow of a combustion gas in a combustion apparatus according to the present invention;

Fig. 2 is a view showing a schematic configuration and a flow of a combustion gas in a conventional combustion apparatus;

Fig. 3 is a perspective view showing a schematic structure of a gas blower;

Fig. 4A is a plan view showing an array state of a pipe of the gas blower;

Fig. 4B is its side view;

Fig. 5A is a plan view showing an array state of a pipe of another gas blower;

Fig. 5B is its side view;

Fig. 6 is a plan view showing an array state of a pipe of still another gas blower;

Fig. 7 is a plan view showing an array state of a pipe of still another gas blower;

Fig. 8 is a schematic view showing a system configuration of another combustion apparatus according to the present invention;

Fig. 9 is a view showing a computation example of a relation between a low level heat generation amount and a combustion gas temperature when a total air ratio is changed;

Fig. 10 is a view showing a computation example of a relation between a low level heat generation amount of a refuse and a combustion exhaust gas temperature and a fluid layer temperature when a combustion air temperature is changed; and

Fig. 11 is a schematic view showing a system configuration of another combustion apparatus according to the present invention.

Description of the Preferred Embodiment

An embodiment to embody the present invention will be described below with reference

to the attached drawings.

Fig. 1 is a view showing a schematic configuration and a flow of a combustion gas in a combustion apparatus according to the present invention.

1 denotes a fluid bed combustion unit. A free board 2 is placed over the fluid bed combustion unit 1, and a post-combustion room 3 is placed following the free board 2. The post-combustion room 3 is placed at a position deviated from a just top of the free board 2. A gas blower 4 of a structure having a plurality of pipes, which are arranged at a predetermined interval and in parallel to each other and will be detailed later, is placed near a boundary between the free board 2 and the post-combustion room 3. A gas discharge hole to blow second air oppositely to combustion exhaust gas flowing into an exhaust port, which will be detailed later, is formed in each pipe of the gas blower 4.

Also, a gas cooler such as a gas cooling device or the like (not shown) is placed behind the post-combustion room 3. A portion sandwiched by this gas cooler and the gas blower 4 corresponds to the so-called post-combustion room 3.

By the way, 5 denotes a combustion substance supplying unit for supplying the combustion substance, such as the city refuses and the like, into the furnace.

In the combustion apparatus having the above-mentioned configuration, a first air A_1 for fluidizing a fluid medium is blown from a fluid bed bottom of the fluid bed combustion unit 1. Also, a second air A_2 is blown into the free board 2. Moreover, a second air A_3 is blown into the gas blower 4.

If the combustion apparatus having the above-mentioned configuration does not has the gas blower 4, the combustion substances supplied into the furnace from the combustion substance supplying unit 5 is combusted in the fluid bed combustion unit 1. Its combustion gas G_1 is raised through the free board 2 and sent through the post-combustion room 3 into an exhaust port (not shown), as shown in Fig. 2. Inside the free board 2, the combustion gas G_1 and the second air A_2 blown into the free board 2 are designed to be mixed to thereby mix unburned gas and air. However, the mixture of the unburned gas and the air is not sufficiently done by this method. The combustion gas G_1 may be short-passed inside the free board 2 so

that a stay time is insufficient.

So, in this embodiment, as shown in Fig. 1, the gas blower 4 is placed near the boundary between the free board 2 and the post-combustion room 3. Thus, when the second air A_3 is blown for the combustion gas G_1 and the second air A_2 to be sent to the exhaust port from the gas blower 4, the mixed exhaust gas G_2 of the second air A_2 and the combustion gas G_1 and this second air A_3 becomes a large circulating flow circulating inside the free board 2. Consequently, the unburned gas and the combustion air are sufficiently mixed, and the short-pass is removed. Hence, the stay time inside the free board 2 of the combustion gas is also extended. The combustion exhaust gas G_3 sufficiently mixed with the second air A_2 blown into the free board 2 and the second air A_3 blown from the gas blower 4 as mentioned above is further combusted in the post-combustion room 3, and flows towards the exhaust port.

By the way, an air A_4 together with the combustion substances leaking into the furnace from the combustion substance supplying unit 5 is also mixed with the circulating mixed exhaust gas G_2.

Fig. 3 is a perspective view showing the schematic structure of the gas blower 4. As shown in Fig. 3, near the boundary between the free board 2 and the post-combustion room 3, a plurality of pipes 4-2, 4-2, ... are arranged at a predetermined interval and in parallel to each other, on a plane orthogonal to a flow path of the combustion gas G_1. The upper portion of the plurality of pipes 4-2, 4-2, ... are opened and linked to an air supply path 4-1. Air discharge ports 4-3, 4-3, ... are formed in the pipes 4-2, 4-2, ... so that respective phases are separated. The air supplied from the air supply path 4-1 is discharged in the direction opposite to the combustion gas G_1 from the air discharge ports 4-3, 4-3, ... of the pipes 4-2, 4-2, ...

The combustion substances such as the city refuses and the like are supplied into the furnace from a supply port 2a formed on an upper wall of the free board 2, and the combustion gas G_1 is raised through the free board 2. This combustion gas G_1 is the mixture of the combustion gas such as CO_2, H_2O, N_2 and the like, the thermally decomposed gas of the combustion substance, the unburned substance such as unburned carbon, and the air

that does not contribute to the combustion. The irregularity of the combustion in a combustion region causes the respective components of the combustion gas G_1 to be irregularly distributed inside the free board 2. Since the second air A_3 is blown oppositely to the combustion gas G_1 from the air discharge ports 4-3 of the pipes 4-2 of the gas blower 4, the combustion gas G_1 becomes the mixed exhaust gas G_2 mixed with this second air A_3. As shown in Fig. 1, it becomes the large circulating flow circulating inside the free board 2. At this time, a different second air A_2 blown into the free board 2 and the air A_4 together with the combustion substances leaked from the combustion substance supplying unit 5 are also mixed, as mentioned above.

In the plurality of pipes 4-2, 4-2, ... of the gas blower 4, the air discharge ports 4-3 are arranged between the pipes 4-2, 4-2 adjacent to each other so that their phases are separated, as shown in Figs. 4A, 4B. The second air A_3 is blown for a combustion exhaust gas EG (the mixed exhaust gas G_2 in Fig. 1) surely and regularly. If this blown direction of the second air A_3 is set to be opposite to the flow of the combustion exhaust gas EG, the combustion

exhaust gas EG is largely circulated in the free board 2. By the way, Fig. 4A is a plan view showing an array state of the pipes 4-2, 4-2 of the gas blower 4, and Fig. 4B is its side view.

Also, the gas blower 4 in which the plurality of pipes 4-2, 4-2, ... are arranged at the predetermined interval and in parallel to each other on the plane orthogonal to the flow of the combustion exhaust gas EG is placed near the boundary between the free board 2 and the post-combustion room 3, as mentioned above. Thus, the gas blower 4 provides the action for shielding the radiation from the combustion exhaust gas EG on the upstream side. Hence, it is expected to protect the drop in the temperature of the radiation. 輻射減温

In the gas blower 4 having the above-mentioned structure, the material of the pipe 4-2 may be properly selected on the basis of a temperature of the combustion exhaust gas EG, a content amount of corrosive substances and the like. However, in a case of an exhaust gas of a high temperature and a strong corrosive property, the configuration is desired which is composed of one or more kinds of silicon carbide, silicon nitride, alumina, zirconia, magnesia, SAIARON, co-zeolite, titanium oxide and the 焼成 ?

サイアロン コージライト

like. In particular, β SiC is further desired from the viewpoint of the strength and the thermal shock resistance.

An angle (θ) between the flow direction of the combustion exhaust gas EG and the discharge direction of the second air A_3 is desired to be set to $90° \leqq \theta \leqq 180°$, as shown in Fig. 5A. If the interval between the pipes 4-2 is long, θ is reduced. However, in order to generate the large circulating flow in the free board 2 oppositely to the combustion exhaust gas EG, $120° \leqq \theta \leqq 150°$ is further preferred. By the way, Fig. 5A is a plan view showing the array state of the pipes 4-2 of the gas blower 4, and Fig. 4B is its side view.

By the way, the shape of the pipes 4-2 of the gas blower 4 is not limited to the cylindrical shape shown in Figs. 4A, 4B, 5A and 5B. However, if it is used under a high temperature and ceramic of a brittle material is used as the material of the pipes 4-2, the cylindrical shape is desired so as not to induce the concentration of thermal stress.

Also, the installation of the pipes 4-2 is not limited to the structure in which only one row is arrayed on the plane orthogonal to the flow of the combustion exhaust gas EG. As

shown in Fig. 6, two or more rows may be arrayed, and the pipes between the rows may be arranged in a shape of zigzag.

Moreover, as shown in Fig. 7, it is allowable to use the structure in which a plate member 4-4 is placed between the pipes 4-2, 4-2.

By the way, the above-mentioned combustion apparatus has been described by exemplifying the fluid bed furnace as the combustion furnace. However, the present invention is not limited to the fluid bed furnace. Another furnace such as the mechanical furnace or the like can be naturally used if it is the combustion furnace for combusting the combustion substances such as the city refuses and the like.

Fig. 8 is a schematic view showing a system configuration of a combustion apparatus according to the present invention. The following members of the structure in Fig. 8 are similar to those of the combustion apparatus shown in Fig. 1. That is, 1 denotes the fluid bed combustion unit, 2 denotes the free board, and 3 denotes the post-combustion room. The post-combustion room 3 is placed at the position deviated from the just top of the free board 2. The gas blower 4 for blowing the gas oppositely

to the combustion gas flowing towards the exhaust port is placed near the boundary between the free board 2 and the post-combustion room 3.

A high temperature heat exchanger 6 is placed in linkage to the post-combustion room 3, イ+リ and the high temperature heat exchanger 6 and a gas cooler 7 are integrated into the single unit. Also, the exhaust gas from the gas cooler 7 is passed through an air pre-heater 8 and a dust collector 9 and discharged into atmosphere through a chimney 11 by an induction fan 10. 12 denotes a first air fan. The air sent by the first air fan 12 is pre-heated by the air pre-heater 8. Then, it is further heated to a predetermined temperature (for example, 500 ℃) and blown into a fluid layer from the bottom of the fluid bed combustion unit 1. 13 denotes a second air fan. The air sent by the second air fan 13 is pre-heated to a predetermined temperature by the high temperature heat exchanger 6, and it is blown as the second air A_2 into the free board 2.

The gas blower 4 has the structure substantially similar to that of the gas blower 4 shown in Fig. 3. The air sent by the second air fan 13 is pre-heated to a predetermined

temperature by the high temperature heat exchanger 6 and blown oppositely to the flow of the combustion exhaust gas as the second air A_3 from the air discharge ports of the pipes of the gas blower 4.

In the combustion apparatus having the above-mentioned configuration, the amount of the first air sent from the bottom of the fluid bed combustion unit 1, namely, the amount of the air for fluidizing the fluid medium is reduced to a theoretical air amount, and the combustion substances are supplied into the furnace to thereby carry out a partial combustion. In this case, because of the partial combustion, the generated heat amount is reduced to thereby drop the temperature of the fluid layer. However, since the first air sent from the first air fan 12 is pre-heated to a high temperature (for example, 500 ℃) by the high temperature heat exchanger 6, a temperature of the fluid layer is kept at 400 ℃ to 900 ℃. In order that the inside of the free board 2 is held in oxidized atmosphere at a high temperature, the content of the first air A_1 and the second air A_2 is set to 1.0 to 1.5 at an air ratio. Moreover, the gas blower 4 blows the second air A_3 to thereby generate a large

circulating flow in the free board 2. Thus, the unburned gas and the combustion air are sufficiently mixed. Hence, the combustion of the high temperature and the high efficiency at a total air ratio of 1.2 to 1.7 and 950 ℃ or more is carried out, in the free board 2 and the post-combustion room 3.

Fig. 9 is a view showing a computation example of a relation between a total air ratio m and a combustion gas temperature when a first air pre-heating temperature is assumed to be 500 ℃ and pre-heating temperatures of the second air A_2 blown into the free board 2 and the second air A_3 blown from the gas blower 4 are assumed to be 200 ℃. In a conventional gas heating type air pre-heater (an exchanger for carrying out the heat exchange between the combustion exhaust gas and the combustion air), the pre-heating temperature is set to 300 ℃ or less, in order to avoid the high temperature corrosion of a heat transfer pipe caused by HCl in the exhaust gas. Thus, it is difficult that the first air pre-heating temperature also exceeds 300 ℃.

This embodiment employs the high temperature heat exchanger 6 that uses, as the heat transfer pipe, ceramic which endures the

high temperature similarly to the pipe 4-2 of the gas blower 4 and has the excellent corrosion resistance. Thus, the combustion air can be pre-heated to 300 ℃ or more. The pre-heating temperature is different on the basis of a combustion gas temperature and a pre-heating air amount. However, in the computation example of the scale of the actual furnace, similarly to the conventional technique, the high temperature heat exchanger 6 carries out the heat exchange between the first air heated by the air pre-heater 8 and the combustion exhaust gas of 1200 ℃. Hence, simultaneously with the preheating to 500 ℃, the high temperature heat exchanger 6 can thermally sufficiently pre-heat the second air (the air A_2 blown into the free board 2 and the air A_3 blown from the gas blower 4) to 200 ℃.

Naturally, as the air ratio becomes lower, the combustion temperature becomes higher. Then, when the total air ratio m is assumed to be 1.2, since the combustion air is pre-heated by the high temperature heat exchanger 6, the combustion substance having a low level heat generation amount of 1000 kcal/kg or more can be combusted at 1000 ℃ or more.

In this embodiment, the gas blower 4

placed between the free board 2 and the post-combustion room 3, and the high temperature heat exchanger 6 placed between the post-combustion room 3 and the gas cooler 7 act as a thermal screen. Thus, it is possible to attain the combustion of the higher temperature in order to protect the radiation temperature drop.

Fig. 10 shows a relation between the combustion air temperature and the temperatures of the fluid bed and the combustion exhaust gas. Then, it is a view showing the computation example when the first air amount is assumed to be 0.5 times the theoretical air amount and the partial combustion is carried out in the fluid bed. In Fig. 10, a white circular mark (○) indicates the temperature of the fluid bed (BED) when the first air is preheated to 200 ℃, a black circular mark (●) indicates the temperature of the free board (FB) when the first air is preheated to 200 ℃ and the second air is at 40 ℃, a white rectangular mark (□) indicates the temperature of the free board (FB) when the first air is preheated to 200 ℃ and the second air is also pre-heated to 200 ℃, a large black rectangular mark (■) indicates the temperature of the fluid

bed (BED) when the first air is preheated to 50 ℃, a small black rectangular mark ( ) indicates the temperature of the free board (FB) when the first air is preheated to 500 ℃ and the second air is at 40 ℃, and an × mark (×) indicates the temperature of the free board (FB) when the first air is preheated to 500 ℃ and the second air is also pre-heated to 200 ℃.

As shown in Fig. 10, in the case of the high calorie refuse, it is possible to easily carry out the high temperature combustion. Preferably, it is necessary to drop the temperatures of the fluid bed and the combustion exhaust gas. However, in the case of the high calorie refuse, the pre-heating temperatures of the first air and the second air act the important role. For example, if the low level heat generation amount of the refuse is 1500 kcal/kg, the temperature of the fluid bed can not be kept at about 600 ℃, unless the first air pre-heating temperature is set to 300 ℃ or more. Thus, in order to keep the temperatures of the free board 2 and the post-combustion room 3 at 1200 ℃, it is necessary to further pre-heat the second air. The upper limit of the temperature of the fluid bed is the temperature at which the reaction with alkali fusion salt and

the like cause the occurrence of fluid defect, and the lower limit thereof is the thermal decomposition temperature of the combustion substance and the temperature necessary for gasification. Usually, those ranges are between 400 ℃ and 900 ℃. It is set to the proper temperature based on the property of the combustion substance. However, it is desired to be set to 500 ℃ to 800 ℃ in order to perfectly carry out the gasification and stabilize the combustion through slow combustion.

As shown in Fig. 10, if the low level heat generation amount of the refuse is 2100 kcal or more, the temperature of the fluid bed becomes 800 ℃ or more (refer to the curved line of the white circular mark) even if the first air pre-heating temperature is 200 ℃. In this case, the reduction in the amount of the first air enables the drop in the temperature of the fluid bed. In order to drop the temperature of the fluid bed, it is possible to use the known approach for carrying out the water atomization, or installing the heat transfer pipe in the fluid bed (or a part of the fluid bed) to carry out the heat collection.

If the low level heat generation amount of

the refuse is 1500 kcal/kg, when the first air pre-heating temperature is set to 500 ℃, the temperature of the fluid bed becomes about 670 ℃ (refer to the curved line of the large black rectangular mark). If the temperature of the fluid bed is kept at 600 ℃, the amount of the first air can be reduced. That is, the first air can be pre-heated up to 500 ℃ by using the high temperature heat exchanger 6 together with the known air pre-heater 8 to thereby carry out the two-stage pre-heating operation. Thus, it is possible to reduce the amount of the first air required to carry out the stable partial combustion in the fluid bed.

Moreover, if the low level heat generation amount of the refuse is 1000 kcal/kg, the first air is pre-heated to 500 ℃, which enables the temperature of the fluid bed to be kept at about 400 ℃ (refer to the curved line of the large black rectangular mark). If the pre-heating temperature is 500 ℃ or less, it is necessary to increase the amount of the first air and increase the rate of the partial combustion in the fluid bed. The temperatures of the combustion gas in the post-combustion room 3 and the free board 2 are determined on the basis of the operational condition of the fluid bed and the

pre-heating temperature of the second air, if the total air ratio is fixed. As shown in Fig. 10, if the low level heat generation amount of the refuse is about 1900 kcal/kg or more, the temperature of the combustion gas becomes 1200 ℃ or more (refer to the curved line of the black circular mark) without any second air pre-heating operation. In this case, it is necessary to cool the gas through the water atomization or the boiler. Of course, the thermal collection may be done in the fluid bed by increasing the rate of the partial combustion in the fluid bed.

If the low level heat generation amount of the refuse is low such as 1000 kcal/kg, as shown in Fig. 10, it is possible to pre-heat the second air to about 200 ℃ to thereby set the temperature of the combustion gas to 1000 ℃ or more (refer to the curved line of the × mark).

As mentioned above, it is possible to make the air ratio low and also possible to pre-heat the combustion air in the high temperature heat exchanger 6 and thereby attain the combustion at the high temperature between 1000 ℃ and 1200 ℃ to further reduce the first air. However, in order to attain the perfect combustion at the low air ratio, it is important

to sufficiently mix and agitate the unburned gas and the combustion air.

Typically, the capacity of the free board 2 is determined by considering the necessary stay time and the dispersion of the fluid medium. However, since a velocity of the combustion exhaust gas is about 1 to 3 m/sec, the sufficient mixture is not done. Also, there is a limit in a method of spraying the limited amount of the second air from the circumferential furnace wall into the free board 2 and thereby improving the mixture of the unburned gas and the combustion air. For this reason, in order to reduce the CO concentration in the exhaust gas, the operation in which the total air ratio is about 2.0 is actually obliged to be carried out.

In this embodiment, near the boundary between the free board 2 and the post-combustion room 3, the large number of pipes 4-2 made of the heat-resistant material as the gas blower 4 are placed on the plane orthogonal to the flow of the combustion exhaust gas. Then, the second air A_3 is discharged oppositely to the flow of the combustion exhaust gas from the air discharge ports 4-3 of the pipes 4-2. Consequently, the combustion exhaust gas, while mixed with this second air A_3, is largely

circulated inside the free board 2. Thus, since the short-pass is removed, the combustion exhaust gas and the second air are sufficiently mixed, and the stay time is extended. Hence, it is possible to attain the perfect combustion.

This embodiment is designed such that the structure member is not installed inside the free board 2 as much as possible. This reason is to avoid the trouble caused by the unburned substance, such as metallic mass and the like, mixed with the combustion substance and to regularly supply the combustion substance onto the fluid bed.

Also, this embodiment is designed such that the air ratio of the free board 2 is 1.0 to 1.2. This reason is to protect the deposition of char induced by the partial combustion in the fluid bed combustion unit 1 at the reductive atmosphere of the air ratio of 1.0 or less, and to combust the char and effectively utilize the heat generation amount of the combustion substance, and to consider the safety of the apparatus so as to avoid the unburned gas from being leaked from the furnace because of the variation in the pressure inside the furnace.

Also, in this embodiment, the fluid bed combustion unit 1, the free board 2, the

post-combustion room 3 and the gas cooler 7 are integrated into the single unit. This reason is to set the temperature of the combustion gas to 1200 ℃ or less to thereby establish the condition that dispersed ash is not easily melted, and to design the structure in which a flue where the fusion trouble of the dispersed ash is easily brought about is not installed.

Fig. 11 is a schematic view showing a system configuration of another combustion apparatus according to the present invention. The configuration of the combustion apparatus in Fig. 11 differs from the combustion apparatus in Fig. 8 in that a boiler 15 is used as the gas cooler 7 and that a heat transfer pipe 16 is laid in a part of the fluid bed combustion unit 1 so as to enable the heat to be collected in the fluid bed combustion unit 1. The other structure is substantially equal to that of the combustion apparatus in Fig. 8. Thus, the detailed explanation of the operations of the respective members and the combustion control method are omitted.

The combustion apparatus is designed as shown in Fig. 11. Consequently, if the high calorie refuse is defined as the targeted combustion substance, an energy efficiency of a

plant can be greatly improved.

Fig. 12 is a schematic view showing a system configuration of another combustion apparatus according to the present invention. As shown in Fig. 12, this combustion apparatus is designed such that the gas blower 4 is placed just above the free board 2, and the high temperature heat exchanger 6 is placed just above the gas blower 4. That is, this is designed such that the post-combustion room is placed just above the free board 2. The other structure is equal to that of the combustion apparatus of Fig. 11.

Due to the above-mentioned structure, the second air is blown into the exhaust gas from the gas blower 4. Thus, the circulating flow such as the above-mentioned embodiment is not generated inside the free board 2. However, a large number of eddies are generated in the downstream side of the gas blower 4. Those eddies enable the second air to be regularly mixed in the exhaust gas. Hence, the perfect combustion is done in the post-combustion room.

Even if the combustion apparatus is designed as shown in Fig. 12, the energy efficiency of the plant can be greatly improved similarly to the case of Fig. 11.

As mentioned above, according to the present invention, the gas blower placed near the boundary between the free board and the post-combustion room blows the second air oppositely to the combustion gas. Thus, while the combustion gas and the second air are mixed, they are largely circulated inside the free board. Hence, the slight amount of the second air is used to surely enable the mixture of the combustible gas and the unburned substance.

Also, the gas blower is configured such that the plurality of pipes are arrayed in parallel to each other near the boundary between the free board and the post-combustion room. Thus, the radiation from the combustion exhaust gas on the upstream side of the pipe row can be shielded to thereby protect the radiation temperature drop.

Also, the fluid bed is set at the low air ratio, and the gasification two-stage combustion through the partial combustion is carried out to thereby enable the reduction in NOx.

Also, the combustion of the high temperature and the high efficiency enables the suppression of the environmental pollution, such as the reduction in the hazardous organic chlorine compound represented by the PCDDs

and the precursor thereof and the like.

Also, the execution of the high temperature combustion at the low air ratio enables the miniaturization of the combustion furnace body, the blower and the units in the gas processing system in the combustion apparatus.

Moreover, as the result of the above-mentioned configurations, the operational cost can be reduced. In particular, in the case of the fluid bed, if the fluidized air amount can be reduced, it is possible to largely reduce the operational cost.

In a case of a combustion facility having a boiler in which the boiler is used as a gas cooler, an energy efficiency of a plant targeting a high calorie refuse is improved.

Advantageous Effects of the Invention

As mentioned above, according to the combustion apparatus according to the present invention and the combustion control method for the same, the gas blower placed near the boundary between the free board and the post-combustion room blows the second air oppositely to the combustion gas. Thus, while the combustion gas and the second air are mixed, they are largely circulated inside the free board.

Hence, the slight amount of the second air is used to surely enable the mixture of the combustible gas and the unburned substance. Also, the gas blower can shield the radiation from the combustion exhaust gas on the upstream side to thereby protect the radiation temperature drop. Therefore, when the city refuses and the like are combusted, the reduction in NOx and the combustion of the high temperature and the high efficiency enable the suppression of the environmental pollution, such as the reduction in the hazardous organic chlorine compound represented by the PCDDs and the precursor thereof and the like

What is claimed is:

1. A combustion apparatus designed such that said combustion apparatus includes: a combustion furnace; a free board following the combustion furnace; and a post-combustion room following the free board, and the post-combustion room is placed at a position deviated from a just top of said free board,

wherein a gas blower for blowing a gas oppositely to a combustion gas flowing towards an exhaust port is placed near a boundary between said free board and said post-combustion room.

2. A combustion apparatus according to claim 1, characterized in that said gas blower has a plurality of pipes arrayed at a predetermined interval and in parallel to each other, and a gas discharge hole to blow a gas in a direction opposite to the combustion gas flowing towards the exhaust port is formed in each of the pipes.

3. A combustion apparatus according to claim 2, characterized in that the gas discharge hole formed in each of said plurality of pipes is formed such that its phase is separated for each pipe.

4. A combustion apparatus according to

claim 1 or 2 or 3, characterized in that said pipe is made of β silicon carbide sinter.

5. A combustion apparatus according to one of the preceding claims 1 to 4, characterized in that said combustion furnace is a fluid bed furnace, and a high temperature heat exchanger linked to said post-combustion room is placed, and a gas cooler is placed behind it.

6. A combustion control method for the combustion apparatus according to claim 5, characterized in that a first air amount blown from a bottom of said fluid bed furnace is set at a theoretical air amount or less, and a partial combustion of a combustion substance is carried out in the fluid bed, and a temperature of a fluid bed combustion unit is kept at 400 ℃ to 900 ℃.

7. A combustion control method for the combustion apparatus according to claim 6, characterized in that the first air blown from said bottom of said fluid bed is pre-heated to a predetermined temperature by using a two-stage pre-heating unit of an air pre-heater and said high temperature heat exchanger, and said first air amount is reduced to thereby reduce a heat generation amount in said fluid bed, and a temperature of the fluid bed is kept at 400 ℃ to

900 ℃.

8. A combustion control method for the combustion apparatus according to claim 6 or 7, characterized in that a second air pre-heated by the high temperature heat exchanger is blown into said free board 2, an air ratio is set to 1.0 to 1.5, and an oxidized atmosphere of a high temperature is generated, and said gas blower further blows the second air pre-heated by said high temperature heat exchanger, and a unburned gas and a combustion air are sufficiently mixed, and a combustion of a high temperature a high efficiency of 950 ℃ or more at a total air ratio of 1.2 to 1.7 is thereby carried out in said free board and said post-combustion room.

9. A combustion control method for the combustion apparatus according to one of the preceding claims 6 to 8, characterized in that a temperature of said fluid bed, a temperature of said free board and a temperature of said post-combustion room are controlled by changing an air weight ratio between said first air, a second air blown into said free board and a second air blown from said gas blower, and respective air temperatures.

Fig1

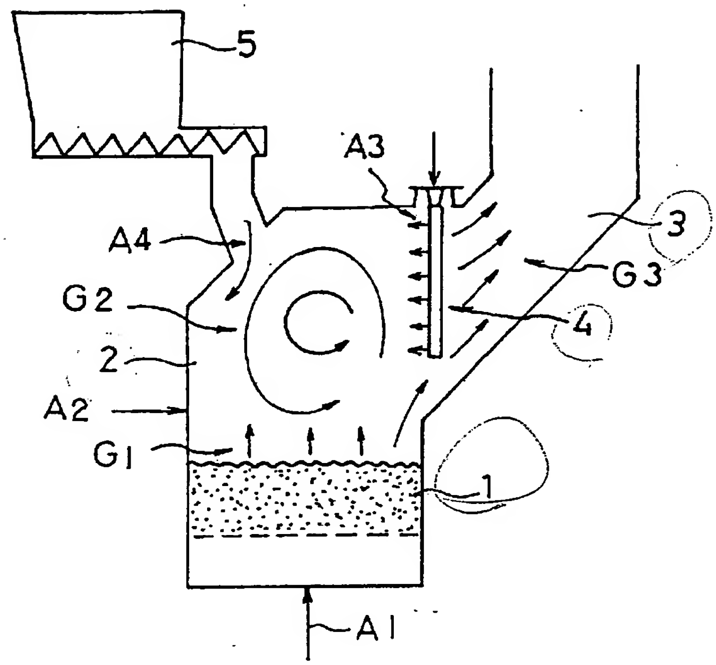


Fig2

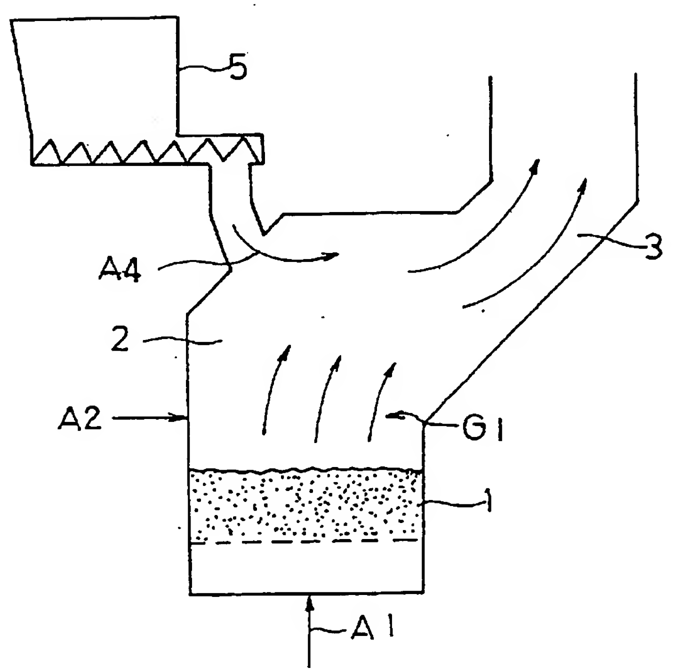


Fig 3

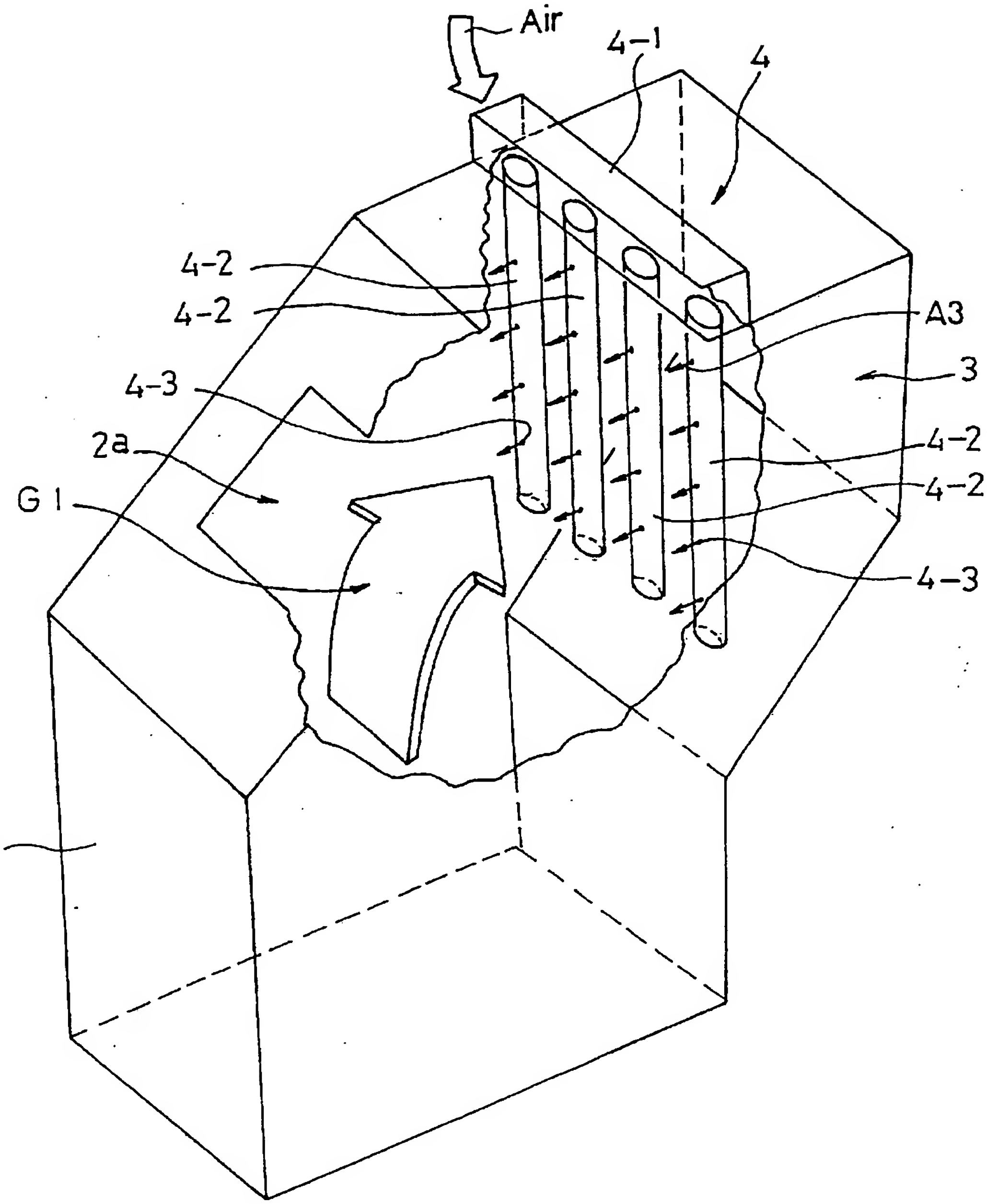
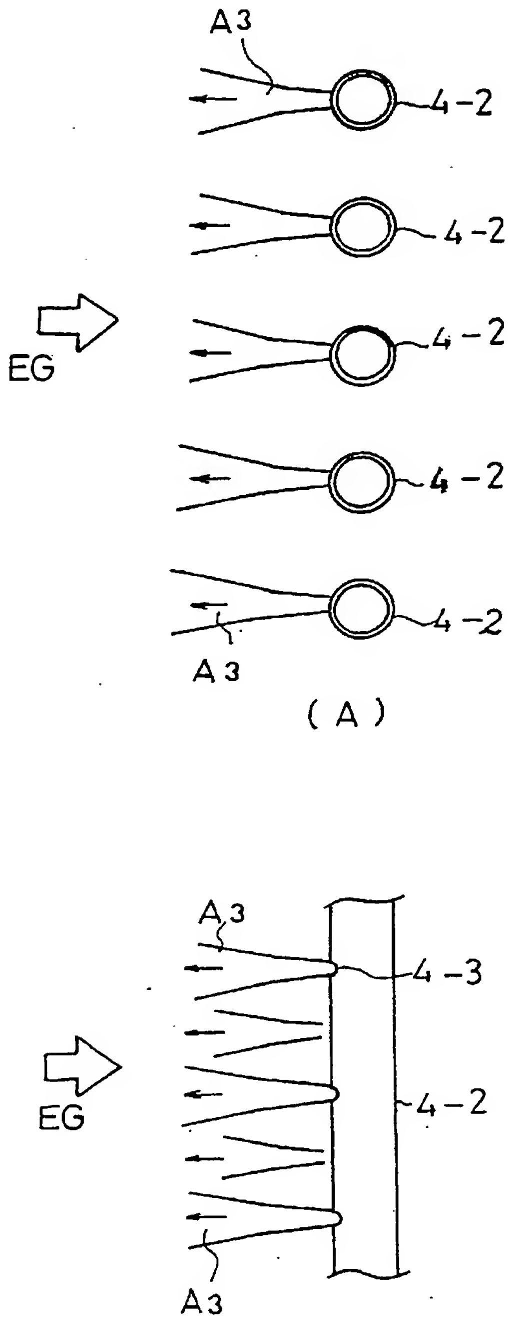


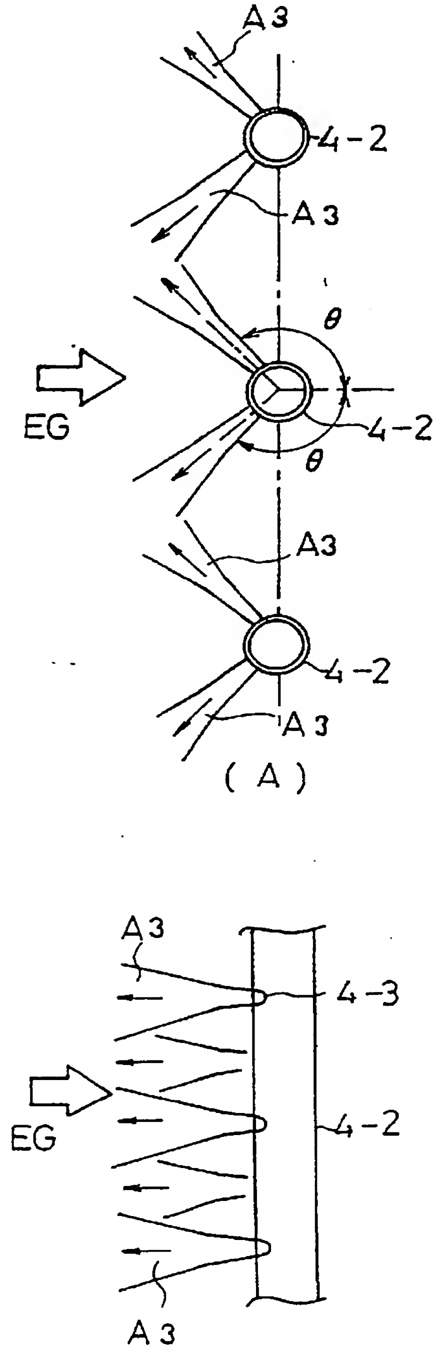
Fig4



(A)

(B)

Fig5



(A)

(B)

Fig 6

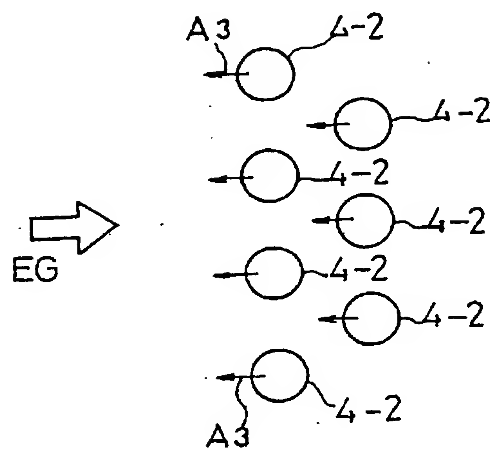


Fig 7

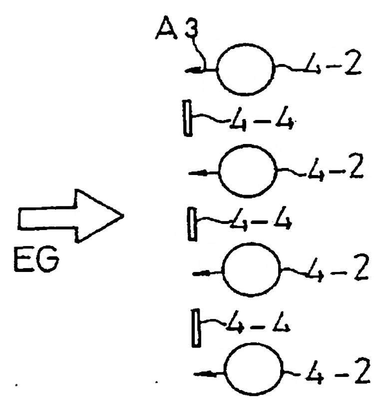


Fig8

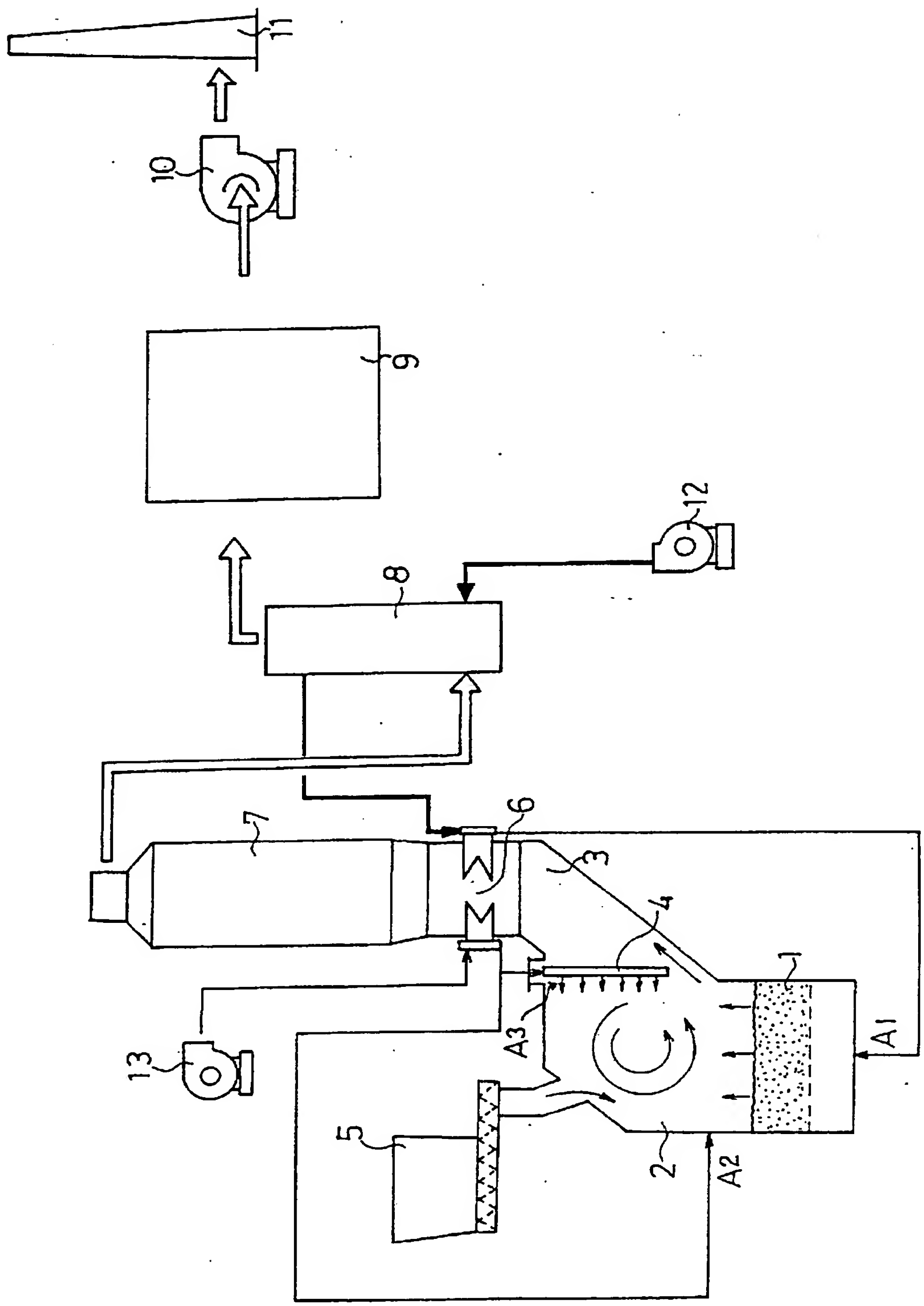


Fig9

空気予熱温度，一次空気500℃，二次空気200℃

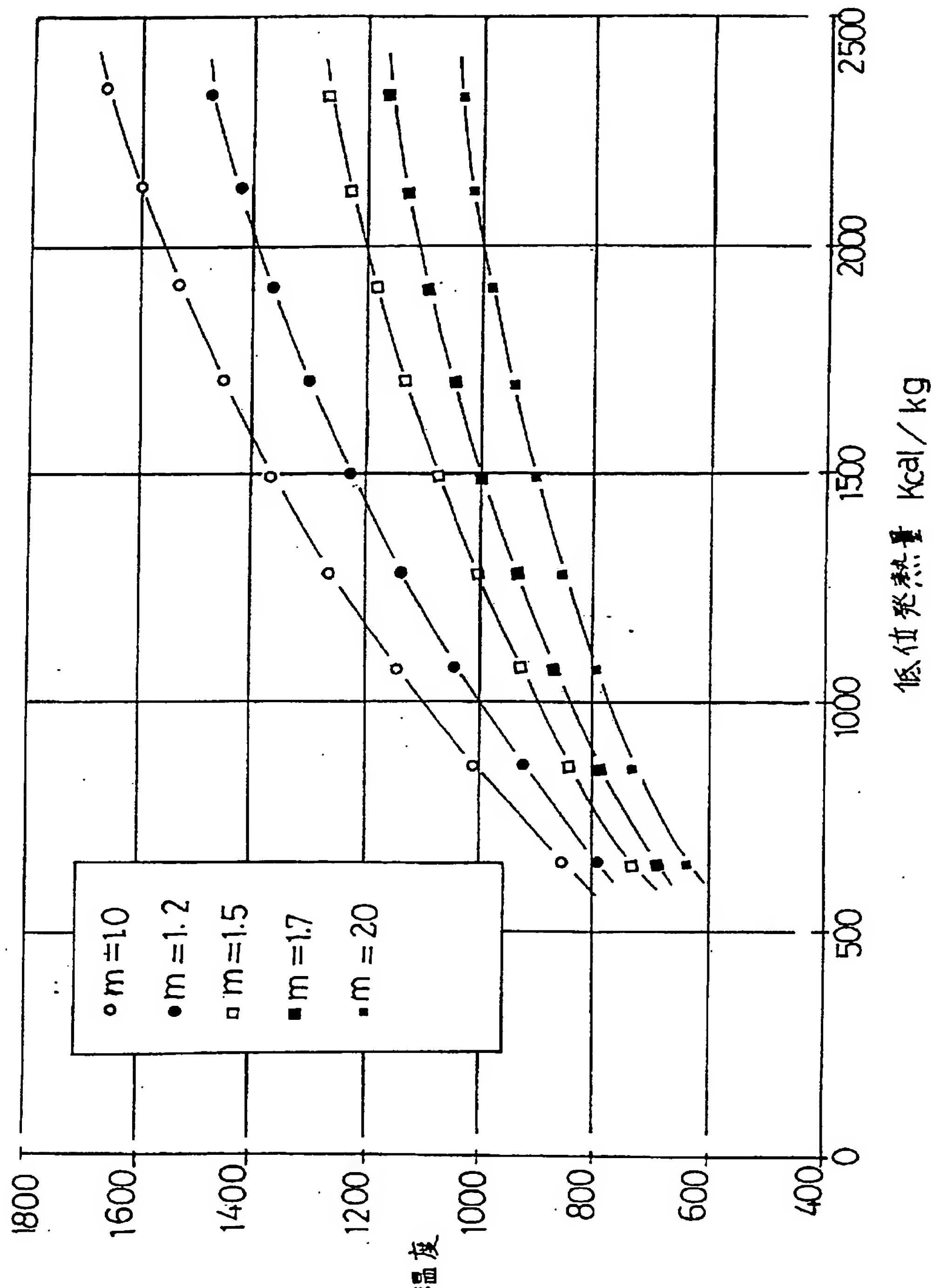
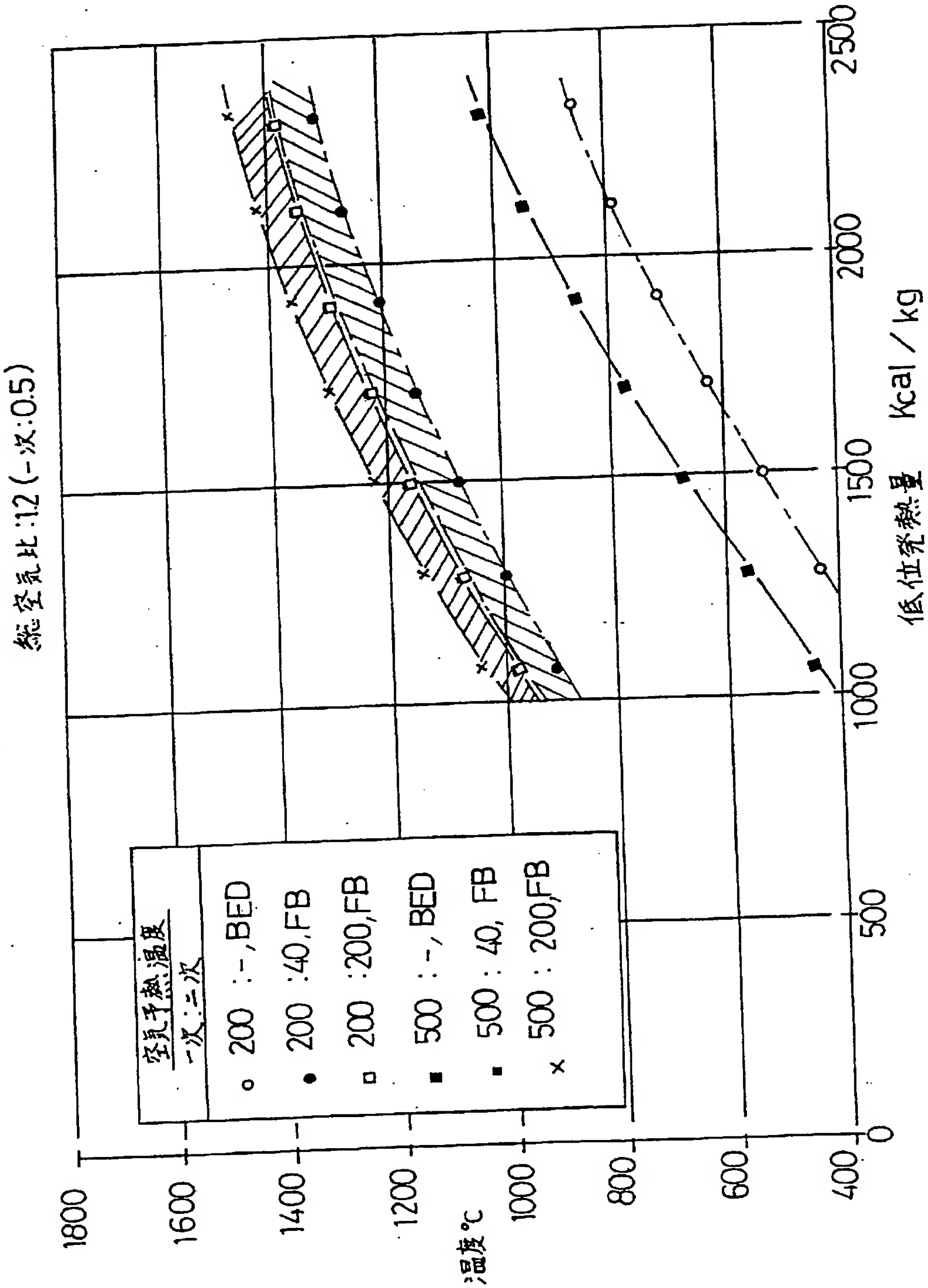


Fig10


総空気比:1.2 (一次:0.5)
空気予熱温度
一次:二次
200 :-,BED
200 :40,FB
200 :200,FB
500 :-,BED
500 : 40, FB
500 : 200,FB
温度℃
1800
1600
1400
1200
1000
800
600
400
0
500
1000
1500
2000
2500
低位発熱量 Kcal / kg

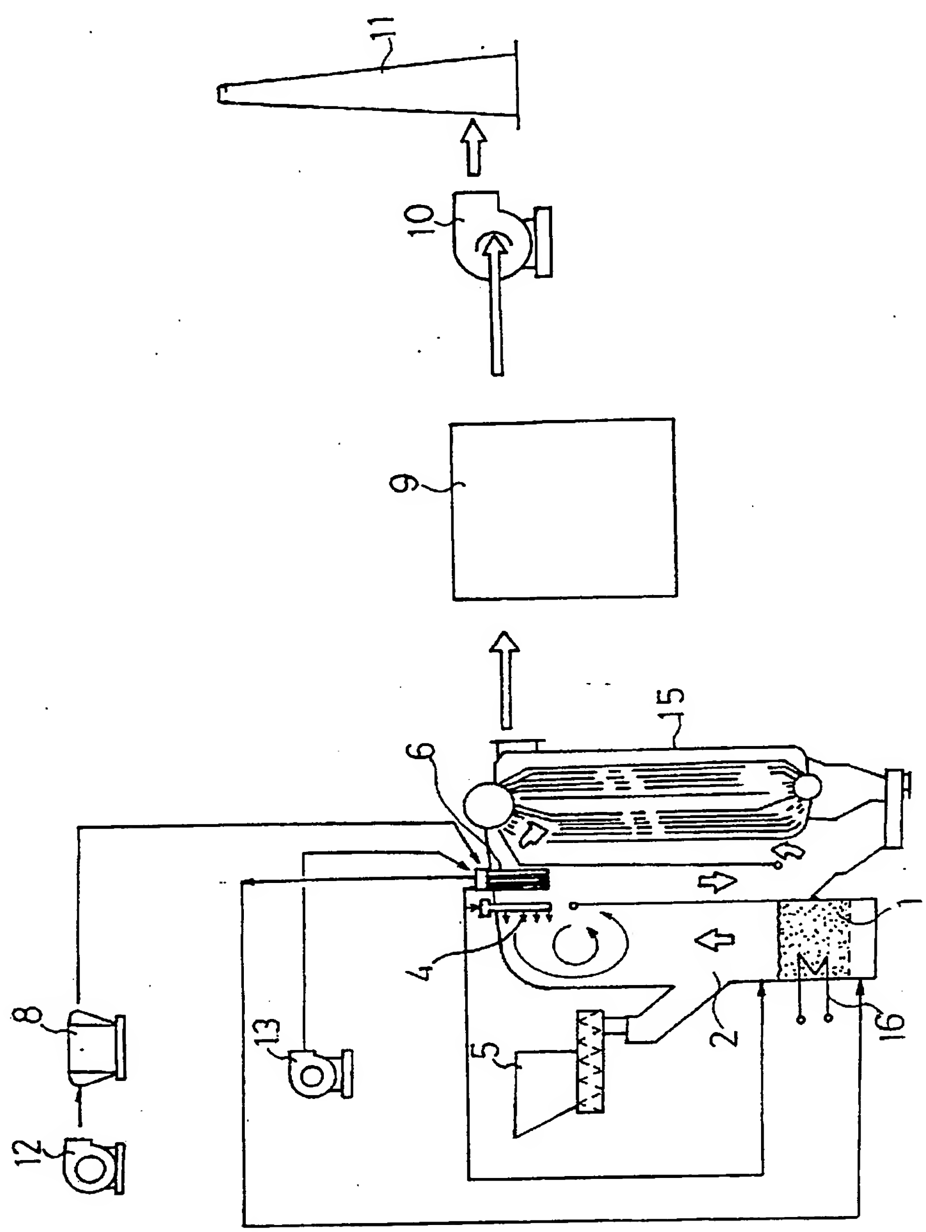


Fig11

Fig12